Grading Northern Red Oak Planting Stock

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A system for morphological grading of red oak nursery stock, based on stem diameter and length, stem form, buds and roots, is described.

During planting experiments from 1976 to 1982 (*11*), some 16,000 northern red oak (*Quercus rubra* L.) seedlings, mostly 2+0 nursery stock, were graded to obtain uniform size and form. The trees were supplied by the nurseries of the Ontario Ministry of Natural Resources. About 40 percent of these in any 1 year of planting were of unacceptable quality. On a provincial scale, this would represent an average of 134,000 of the 336,500 seedlings produced each year in ministry nurseries (*9*). It became apparent that morphological grading of planting stock would be necessary in addition to the rather minimal standards for planting stock size, as recommended for average sites in Ontario (*12*). Procuring acorns from local trees with desired phenotypic characteristics (*5, 6*) should also be a minimal practice in hardwood tree improvement programs. It is the purpose here to suggest improved grading standards for red oak to be used in field plantings in southern Ontario.

The grading criteria are based on root-collar diameter and stem length (table 1) and stem form, bud number, and roots of large and small 2+0 nursery stock (figs. 1 and 2). Stock should be graded in nurseries before bundling or on a planting site to avoid the cost of planting inferior stock, which will perform poorly.

Table 1—*Provisional root-collar diameter and stem length grades for 2+0 red oak nursery stock*

Seedling size	Root-collar diameter (mm)	Stem length (cm)
Large	7.5–8.5	55–75
Small	4.5–6.5	30–45
Cull	< 4.5	—

Stem Diameter and Stem Length

Stem diameter and stem length are the criteria with the greatest variations among nurseries, years, and seed sources and should be the basis for judging quality of planting stock (*8, 14*). In Ontario plantings, root-collar diameter and stem length were reliable indicators of relative growth potential regardless of age of stock (*12*). A caliper of 8 millimeters, measured 2 centimeters above the root-collar, and a shoot length from 50 centimeters to 1 meter have been recommended for red oak (*3,4*).

I have observed in numerous plantations that rabbits tend to clip plants of about 6.5 millimeters stem diameter or less often to ground level, leaving a stump that seldom resprouts because it has no dormant buds. This is usually the case with 1+0 nursery stock of small root-collar diameter. Larger diameter stock, however, is seldom clipped to the ground level, and dormant buds are left along the lower stem and near the root-collar, thus allowing resprouting. When clipped seedling stock resprouts, the growth of the sprout will be more vigorous on larger diameter stumps than on smaller ones.

Stem Form

The stem should be well defined and straight, with relatively short branches on the previous year's growth. Long branches (fig. 1, sample 5) should be pruned and multiple leading shoots should be pruned to leave the sturdiest shoot (fig. 2, sample 6) on seedlings that have met all other criteria. I have observed that thin whip-like long stems (fig. 1, sample 6; fig. 2, samples 7 and 8) usually grow very slowly. Seedlings with multiple stems should be culled and the sources of acorns that do poorly identified (*7*).

Buds

The stem should have numerous buds, especially on the last year's growth, and a cluster of buds at the apex. Buds should not be swollen or flushed at the time of planting. Acorns from more southerly sources tend to produce seedlings that flush early

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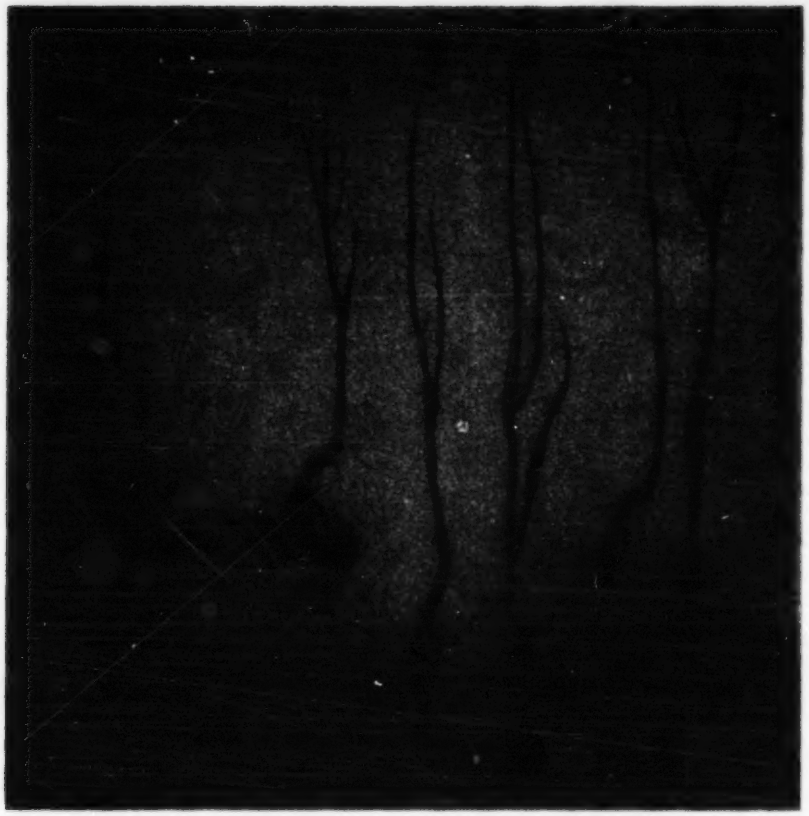

Figure 1—*Large 2+0 nursery stock of northern red oak after lifting.*
Class 1—*Seedlings 1 and 2 (acceptable). Leading shoot is well defined, sturdy, and straight with buds on most of stem. Branches are relatively short, mainly on previous year's growth.*
Class 2—*Seedling 3 (acceptable). Leading shoot less defined and less sturdy than grade 1 with fewer buds and more prominent branches.*
Class 3—*Seedings 4 and 5 (acceptable). Leading shoot is thin or forked with prominent branches. Large root-collar diameter ensures resprouting when stem is decapitated or injured due to browsing or girdling. Prune branches, particularly the upper branch on 5.*
Class 4—*Seedlings on 6 and 7 (culls). Stem is very thin with questionable resprouting capacity when decapitated or injured and/or tendency to forking prominent.*
Root pruning. *Tap root should be pruned to 20 to 25 centimeters length and lateral roots to 10 to 15 centimeters length (to facilitate spreading out roots in planting hole).*

and are thus more susceptible to frost damage. An important and consistent difference between geographic sources in red oak has been found in the dormancy requirements (*7, 13*).

Roots

Undercutting of roots before seedlings are lifted from the nursery beds shortens the tap root, often resulting in a "hockey stick" root but leaving most of the lateral roots up to 1 meter long intact. Although this undercutting may not affect the vigor of a young tree, the weight of the developing crown cannot be properly supported and mechanical damage to the roots may result after outplanting, as found in several coniferous species (*2*). In addition, such bent roots may be more susceptible to root rot, as found in planted white spruce (*10*). Because seedlings develop new roots soon after planting, additional pruning of lateral roots is good practice to prevent long roots from being placed close to the surface of a conventional planting hole. Pruning to about 20 to 25 centimeters is therefore recommended for red oak to facilitate field planting and ensure a high rate of survival (*4, 6*).

Figure 2—*Small 2+0 nursery stock of northern red oak after lifting.*
Class 1—*Seedling 1 (acceptable). Leading shoot sturdy, straight with buds on most of stem. Branches usually absent.*
Class 2—*Seedlings 2 and 3 (acceptable). Leading shoot less sturdy than grade 1. Branches sometimes relatively too long as in 3.*
Class 3—*Seedlings 4 to 6 (acceptable). Stem with 2 to 3 leading shoots. Ensure presence of terminal buds on the sturdiest shoot and prune the remaining ones.*
Class 4—*Seedlings 7 to 13 (culls). Stem of poor form, very thin, tendency to forking prominent.*
Root pruning. *Tap root should be pruned to 15 centimeters length and lateral roots to 10 centimeters length (to facilitate spreading out roots in planting hole).*

Conclusion

Red oak nursery stock can be graded by assessing relatively easily observable criteria. Stock of better quality should improve the performance of red oak plantations in Ontario. This should also strengthen the confidence in propagating oak where it grows faster and is of better quality than, for example, sugar maple (*1*). Use of acorns from selected local phenotypes should also be a standard practice to maximize propagation of sources with rapid juvenile growth and other important characteristics.

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Reprinted From

Tree Planters' Notes

U.S. Department of Agriculture
Forest Service
Vol. 36, No. 1
Winter 1985